CHAPTER 8
Standing Water Assessment

Introduction
Iowa has 5,432 recognized "standing waters," including lakes, reservoirs, ponds, and wetlands, covering 161,366 acres. While the majority of these are farm ponds and small wetlands, 115 are significant publicly owned lakes, four are flood control reservoirs (Coralville, Red Rock, Rathbun, and Saylorville), and 67 are "**meandered**" lakes.

Lentic waters is a broad term that encompasses all standing waters. Lakes are either naturally formed or constructed. Naturally formed lakes include glacial lakes and **oxbow lakes**. Several advances of glacial ice into Iowa stagnated, depositing large blocks of ice on the landscape. **Glacial till**, unsorted glacial material, was deposited around these blocks of ice, and when the ice melted, kettle lakes were created. Oxbow lakes and backwater marshes form as meandering streams cut off their own meanders, leaving behind a body of standing water. Reservoirs, on the other hand, are formed by building a dam across a stream.

For the purposes of water monitoring, standing waters will be referred to as "lakes." Lakes serve as "sinks," or storage areas; everything (sediments, chemicals, nutrients, etc.) transported through watersheds eventually find their way into standing waters, where the pollutants may become concentrated and their effects can be observed. This is the natural function of standing waters – to collect water, clean it, and then release it. Therefore, lakes are direct reflections of the watersheds around them.

Site Selection
The number and location of your monitoring sites will be influenced by the goals and objectives of your monitoring program. A program designed primarily for public education, for example, may include sites for non-scientific reasons, such as their proximity to residential neighborhoods or convenience of access. Such a program may even include more monitoring sites in a lake than necessary for scientific goals so more volunteers can participate in monitoring.

A program that is designed to collect scientific data will focus on the most representative location of the lake for your monitoring site. In most cases, this will be in the deepest, open water area of your lake. Average conditions are best represented by a site of this nature. The deepest point in circular, natural lakes is usually near the middle. The deepest section of a human-made reservoir is usually near the dam. Lakes that have large arms or bays should be sampled in the deepest section of each individual arm or bay.

Other considerations for selecting lake monitoring sites:
- The location of the monitoring site needs to be consistent. In the field, identify and locate your sampling site location. Once identified, the site should be clearly marked on a lake map. This site should then be registered on the IOWATER database in the same manner as stream sites are registered.

- For shoreline or dock monitoring sites, finding the site will be less of a problem, but the location still needs to be documented.
- As with stream monitoring, background research and "The Driving Tour" of the watershed is recommended. Some sources of information for lakes could include:
  - Bathymetric (depth contour) maps or general knowledge of the location of maximum depth area of the lake. Soundings with a "depth finder" can be used and a suitable monitoring location identified. Many of Iowa's lakes have bathymetric maps available from the Iowa DNR.
  - Watershed and topographic maps that show the lake's major inflows and outflows.
  - Information on any current activities in the watershed, including point sources, such as water treatment discharges, storm drain overflows, or failing septic systems, and nonpoint sources, such as agricultural and urban land uses and construction areas that may affect sampling results.
  - Information on any current lake activities, like dredging, water level draw-downs, and chemical applications that may affect sampling results.

Point Sampling

To ensure consistency when conducting lake monitoring, a **point sampling** method (sampling from a specific depth) is used. Sampling from a specific depth, or point, in the lake water column is called point sampling. IOWATER's method of point sampling will be to a depth of approximately one-half meter, following these steps:

1. Rinse the sampling cup three times in an area away from where you will sample.
2. Submerge the sample cup upside-down into the water to elbow depth (1/2 meter).
3. Slowly turn the bottle right side up.
4. Gently lift the bottle out of the water.
5. Do chemical monitoring with sample.

IMPORTANT: Use a separate water sample for each chemical parameter monitored. This method will be used for pH, Nitrite-N / Nitrate-N, dissolved oxygen, phosphate, and chloride as discussed in the chemical assessment section of this chapter.

Frequency of Monitoring

IOWATER suggests beginning lake monitoring at spring ice-out and continue until fall freeze-over on a monthly schedule. If this is too rigorous of a schedule, or if the goals and objectives of your program don't require this frequency, set a schedule that works for you. The most important concept is <u>consistency</u>. If you sample the first week of May, July, and September, be sure to repeat this as closely as possible the next year.

In general, IOWATER recommends to conduct sampling between 10 a.m. and 3 p.m. Understand, however, that there is flexibility in both the day and time, especially in consideration of weather conditions. Use good judgment as to when to sample. IOWATER recommends that you not sample alone and be sure to let someone know when and where you are going out to sample. Under no circumstances should volunteers be on the water during rain or electrical storms, high winds (white caps), thin ice, or other unsafe conditions.

Habitat Assessment

Inlets/Outlets

It may be useful to your efforts to conduct IOWATER stream monitoring on all lake inlets and outlets. By monitoring water inlets, you may be able to distinguish if they are significant contributors of pollution, or if fluctuations in various parameters correlate with fluctuations in your lake assessments. For example, do "spikes" of inlet measurements in phosphate and nitrate and decreases in water clarity correlate with increased algal growth in your lake? Measuring outlet information may be useful in determining if the lake is contributing to downstream sediment or nutrient loading. It may also gage the effect your lake has on water quality as it passes through the system.

Use caution, here, when drawing conclusions of cause and effect. Many variables that are not measurable may be contributing to water quality, such as rainfall directly on the lake, groundwater flows from underground aquifers, leaking city sewers, and private septic systems. Your monitoring information can act as tools to identify trends or send up "red flags" to a potential problem, but it will probably not tell the full story of what is happening within your water body.

Lake Banks

Documenting the condition of the lake banks over time may be useful. On the IOWATER database, you will be able to give a written description of your lake bank assessment. Be sure to include approximate relative distances if possible (e.g., most of south shore is riprap covered, west shore from southern **riprap** to Eagle Point is the gently sloping grass bank of Swan State park, rest of west shore and whole north end is cattails with gently sloping bank, and east shore down to Smith property where the riprap starts is cut-bank eroding).

Adjacent Land Use

As with the lake bank description, adjacent land use will act as a narrative of the land use activities surrounding the lake. Using the same categories for this parameter as IOWATER Stream monitoring (agriculture, urban, light industrial, etc.), estimate the percentage of each type of adjacent land use. If you have had changes that will not be reflected in the above categories that you wish to document, please use the "Other Assessment Observations and Notes" section at the end of the assessment form.

Physical Assessment

Weather

Weather categories are the same as the IOWATER Stream Monitoring categories except for the addition of wind direction and wind speed. Wind direction refers to the direction the wind is coming from.

Water Clarity - Secchi Disc Transparency

A Secchi disc is used to measure water clarity, or how deep a person can see into the water. A Secchi disc is a circular disk, about 20 centimeters (8 inches) in diameter, painted with black and white quadrants. It is a standard piece of equipment used by scientists and volunteers since its development in 1865 by Professor P.A. Secchi.

There are many factors that affect water clarity. Do not assume algal density is directly measured by Secchi reading! How deep a person can see into the water can be affected by many natural and unnatural factors occurring both inside and outside the lake.

Inside the lake, water clarity can be reduced by:

- Organisms such as diatoms and plankton
- Dissolved materials that are natural or unnatural
- Sediment suspended in the water column

Outside the lake, water transparency can be misinterpreted by:

- Human error, such as the observer's eyesight
- Time of day, latitude, and season of the year, which affect the angle that sunlight strikes the lake surface
- Cloud cover, rain, and other weather conditions
- Conditions of water surface, such as waves, sun glare, and surface scum

Because of these factors, transparency measurements taken with the Secchi disc should only be considered a baseline. In order to prove a direct correlation between algae and a reduction in transparency, a direct measurement of the algal population must be made. A measurement of algal population would include sampling for **chlorophyll**, which is not a field test.

Secchi Disc Procedures

The following procedures are modified, with permission, from the Illinois Environmental Protection Agency and Northeastern Illinois Planning Commission's *Volunteer Lake Monitoring Program Training Manual* (April 1997):

1. Travel to your monitoring site. Remove sunglasses.
    a. If monitoring from a boat, carefully lower an anchor over the side until it reaches the bottom. The force of the anchor hitting the lake bottom will disrupt a certain amount of bottom sediment. Let out plenty of anchor line so that the boat drifts away from the sediment plume that may have been kicked up by the anchor.
2. Attach the Secchi disc to the tape measure. Lean over the shaded side of the boat/dock and slowly lower the Secchi disc into the water until it is no longer visible. In some cases, the following special circumstances may apply:
    a. In some shallow lakes, it is impossible to get a Secchi disc reading because the disk hits the bottom before vanishing from sight. This means the true Secchi disc reading is greater than the depth of the lake in that location. In this case, use a transparency tube to get a reading of water clarity and record results on the Standing Water field form.
    b. Sometimes the Secchi disc is lost from view because it "disappears" into the dense growth of rooted aquatic plants. Try moving a few feet away to improve sight of the Secchi disc through the vegetation. If this doesn't work, use a transparency tube to get a reading of water clarity and record the results.
3. When the disc is no longer in view, mark the tape measure with a paperclip.
4. Lower the disc a few more feet in the water, and slowly raise it back towards the surface. When the disc reappears, mark the tape measure at the water's surface with a paperclip. Bring the tape measure and disc back into the boat.
5. Form a loop between the two clothespins. Use a third clothespin to mark the center of the loop. This marks the "average" of the two readings and is considered to be the Secchi depth. Record the results on the IOWATER Standing Water Assessment field form.
6. Follow the procedures below to determine water color.

Water Temperature

Water temperature should be taken at a depth of approximately one-half meter (elbow depth).

Water Level
The categories IOWATER will use for water level in lakes are "normal," "low," or "high." Many of you may have access and the ability to more precisely measure the lake water level in terms of inches above or below "normal", and we encourage you to document this on your field form and in the IOWATER database if possible.

Water Odor
The water odor categories on the lake assessments form are the same as those used with stream monitoring, with the exclusion of the category "Musky" and addition of "Fishy."

Chemical Assessment

REMEMBER – Point Sampling! To collect water samples for chemical assessments submerge the sample cup upside-down into the water to elbow depth (1/2 meter), turn the cup right side up, and gently lift the cup out of the water. Use a separate water sample for each chemical parameter monitored.

pH
Very rarely do problems with pH occur within Iowa surface waters because of limestone bedrock and carbonate minerals in our soils. The average pH in Iowa lakes is 8.0. Except for the point sample collection procedure, IOWATER Stream Monitoring procedures apply. For more information on pH see Chapter 6 of this manual.

Nitrite-N and Nitrate-N
Except for the point sample collection procedure, IOWATER Stream Monitoring procedures apply. For more information on nitrogen in surface water, see Chapter 6 of this manual.

Phosphate
Phosphorus is essential to plant growth and reproduction. Plants and algae most readily take up a form of phosphorus known as orthophosphate, or "free phosphate," which is the simplest form of phosphorus found in natural waters. Orthophosphate is so quickly taken up by growing algal populations that, if present, it is typically found in low concentrations. Since phosphate is taken up more readily than nitrate, it is often regarded as a **limiting resource** for algal growth.

Except for the point sample collection procedure, IOWATER Stream Monitoring procedures apply.

Dissolved Oxygen
The amount of oxygen in water is an important indicator of lake health. Many experts consider dissolved oxygen to be the most important parameter used to characterize lake water quality, and DO plays a crucial role in determining the types of organisms that can live in a lake. Some species, such as many sport fish, need consistently high oxygen concentrations to survive. Other aquatic species are more tolerant of low or fluctuating concentrations of oxygen. Oxygen is supplied naturally to a lake through the diffusion of atmospheric oxygen into the water (enhanced by wind and waves) and the production of oxygen through photosynthesis by aquatic plants and algae.

Water temperature affects the capacity of water to retain dissolved oxygen. Cold water can hold more oxygen than warm water. Therefore, a lake will typically have a higher concentration of dissolved oxygen during the winter than the summer.

Algae and aquatic plants produce oxygen as a by-product of photosynthesis, but also take in oxygen for respiration. Respiration occurs all the time by both plants and animals but photosynthesis occurs only in the presence of light. Consequently, a lake that has a large population of algae or plants can experience a great fluctuation in dissolved oxygen concentration during a 24-hour period. In extreme cases, the oxygen in the water can become depleted during the late evening and pre-dawn hours because of plant and animal respiration.

Except for the point sample collection procedure, IOWATER Stream Monitoring procedures apply.

Chloride

Except for the point sample collection procedure, IOWATER Stream Monitoring procedures apply. **Remember to convert the Quantab Units into mg/L using the chart provided on the vial.**